Document No.: M01-00-E-03

PRODUCT SPECIFICATION

PRODUCT: MULTILAYER CERAMIC CAPACITOR

TYPE : CHIP CAPACITOR

APPROVED BY CUSTOMER

PAN OVERSEAS ELECTRONIC CO., LTD.

TAIWAN HEAD OFFICE:
TEL: 02-25213252~5, 02-25634133
FAX: 02-25373069

TAIWAN FACTORY:
TEL: 06-6982143, 06-6982331
FAX: 06-6983400,(QA:06-6993898)

PAN OVERSEAS (GUANG ZHOU):
TEL: 86-20-82237476
FAX: 86-20-82237475

PAN OVERSEAS (KUN SHAN):
TEL: 86-512-57707888
FAX: 86-512-57711076

QUALITY ASSURANCE DEPARTMENT		
APPROVED	CHECKED	PREPARED

■TAIWAN □GUANG ZHOU □KUN SHAN

PAN OVERSEAS UK

1. SCOPE

This specification is applicable to Pan Overseas multilayer ceramic capacitors.

2. CODE CONSTRUCTION：

U	0805	C	102	J	N	T
①	②	③	④	⑤	⑥	⑦

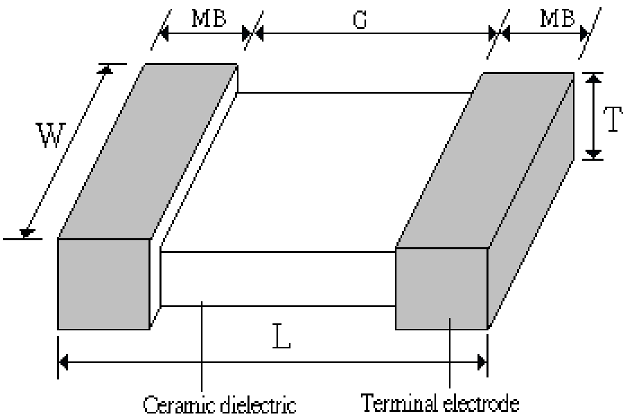
① Rated Voltage:

Code	Rated voltage	Code	Rated voltage	Code	Rated voltage	Code	Rated voltage	Code	Rated voltage
K	6.3V	T	25V	G	200V	D	630V	M3	3000V
N	10V	U	50V	H	250V	M	1000V	M4	4000V
B	16V	A	100V	C	500V	M2	2000V	M5	5000V

② Part Dimension：

Unit: mm

	Dimension					
	Length (L)	Width (W)	Thickness (T)	MB(Min)	G(Min)	
0402	1.0±0.05	0.5±0.05	0.5±0.05	0.10	0.30	6.3～ 50V
0603	1.6±0.1	0.8±0.1	0.8±0.1	0.20	0.40	6.3～250V
0805	2.0±0.2	1.25±0.1	1.40 max.	0.25	0.70	6.3～500V
1206	3.2±0.2	1.60±0.2	1.52 max.	0.25	1.40	6.3～1KV
1210	3.2±0.3	2.5±0.3	1.8 max.	0.25	1.40	6.3～1KV
1808	4.5±0.35	2.0±0.3	2.0 max.	0.25	2.15	6.3～5KV
1812	4.5±0.35	3.2±0.3	1.8 max.	0.25	2.15	16～5KV
2220	5.7±0.4	5.0±0.4	1.8 max.	0.25	3.30	16～5KV
2225	5.7±0.4	6.3±0.4	1.8 max.	0.25	3.30	16～5KV
3640	9.2±0.5	10.16±0.5	2.0 max.	0.50	2.70	16～5KV
5550	14.0±0.5	12.7±0.5	2.5 max.	0.50	10.5	16～5KV
8060	20.3±0.5	15.24±0.5	2.5 max.	0.50	16.8	16～5KV



③ Temperature Characteristics Code:

Code	Temp. Coefficient	Operation Temp.	Capacitance Change
C	NP0 (Class I)	-55℃ ～ +125℃	0 ± 30 ppm/℃
R	X7R (Class II)	-55℃ ～ +125℃	± 15%
X	X5R (Class II)	-55℃ ～ +85℃	± 15%
F	Y5V (Class II)	-30℃ ～ +85℃	+22% ～ -82%
E	Z5U (Class II)	+10℃ ～ +85℃	+22% ～ -56%

④ Capacitance Code：

Code	Capacitance(pF)	Code	Capacitance(pF)
010	1 *	102	1000 *
1R5	1.5	222	2200 *
100	10 *	472	4700 *
101	100 *	103	10000 *

⑤ Tolerance Code：

Code	Tolerance	Code	Tolerance
B	± 0.1pF	J	±5%
C	±0.25pF	K	±10%
D	±0.50pF	M	±20%
F	± 1%	Z	+80% / -20%
G	± 2%		

PS: 1. * -- Two significant digits followed by no. of zeros

2. Temperature coefficient (T.C.) vs. Proper tolerance applied:

NPO: For all tolerance

X7R、X5R: K、M Tolerance

Y5V、Z5U: M、Z Tolerance

⑥ Termination Code：

Code	N
Termination Type	Nickel

⑦ Packaging Code：

Code	B	T
Packaging Type	Bulk	Tape & Reel

3. STANDARD TEST CONDITIONS：

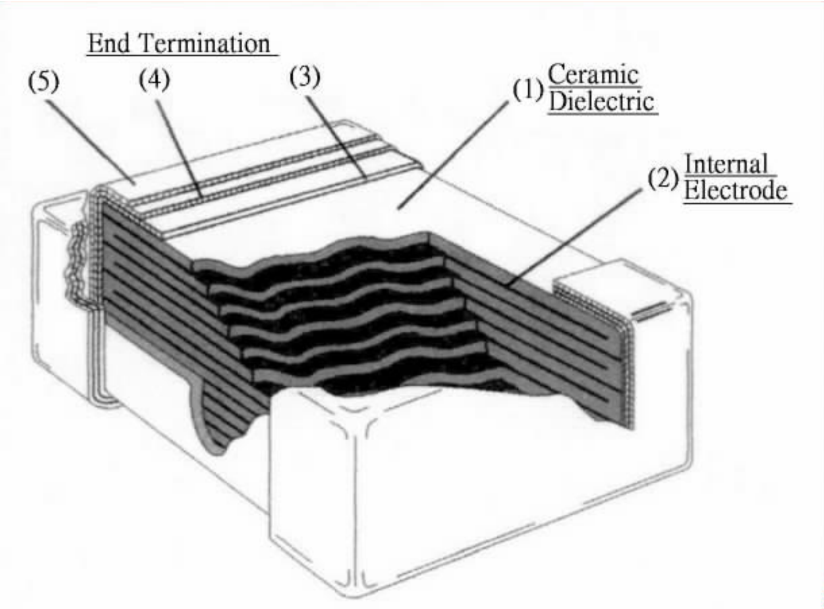
Tests shall, unless otherwise specified, be carried out at 15 to 35℃ and RH 45 to 75%.

If any doubt and argument has been encounter in judgement, the final test shall be done at 25±2℃,RH45 to 55% and 860～1060mbar. (Based on JIS standard)

4. DISPOSITION

If question to the measuring result in judgement, take the capacitor under a specified temperature for 30 minutes at least before measurement.

5. STRUCTURE:



Ag / Pd SERIES：

NO	Specifications	Material	Termination Plating thickness
1	Ceramic dielectric	Ceramic	
2	Internal Electrode	Ag-Pd	
3	End Terminal	Ag layer	40 μm min
4		Ni layer	1.5-3.5 μm min
5		Sn-Pb layer or Sn layer	3-8 μm min

BME SERIES：

NO	Specifications	Material	Termination Plating thickness
1	Ceramic dielectric	Ceramic	
2	Internal Electrode	Ni	
3	End Termination	Cu layer	40 μm min
4		Ni layer	1.5-3.5 μm min
5		Sn-Pb layer or Sn layer	3-8 μm min

6. STORING CONDITION AND TERM

Recommends the storing of products within 6 months at temperature 15～35℃ and humidity 70%RH max. If the product stored over 6 months, please reconfirm its solderability before use.

7. PERFORMANCE:

NO.	Item	Performance	Test or Inspection method
(1)	External Appearance	No defects which may affect performance.	Visual inspection & Dimension measurement
(2)	Voltage Proof	Withstand test voltage without Insulation breakdown or other damage.	DC Tested voltage shall be applied for 1～5sec. Charge/discharge current shall not exceed 50 mA . (PS: Ra – Rated Voltage)

Rated voltage	DC Tested voltage		
	NPO	X7R/X5R	Y5V
≦200V	2.5Ra		
250V	2.0Ra		
500V/630V	1.5Ra		
≧1KV	1.5Ra	1.25Ra	-----

NO.	Item	Performance	Test or Inspection method
(3)	Insulation Resistance	NPO: 100,000MΩ Min. or R・C ≧ 1,000 Ω・F (Whichever is smaller) X7R, X5R, Y5V, Z5U: 10,000MΩ Min or R・C ≧ 1,000Ω・F (Whichever is smaller)	Apply DC tested voltage for 60± 5 minute. (PS: Ra – Rated Voltage)

Rated voltage	DC Tested voltage
<1KV	1.0 Ra
≧1KV	1KV

NO.	Item	Performance	Test or Inspection method
(4)	Capacitance (Cap.)	Within the specified tolerance that refers on page 2	Measuring frequency: Z5U、Y5V、X7R、X5R：1KHz± 50Hz。 NPO：>1000pF：1KHz± 50Hz。 ≦1000pF：1MHz± 100KHz Measuring voltage: Z5U：0.5 Vrms NPO、X7R、X5R、Y5V：1.0± 0.2 Vrms
(5)	Dissipation Factor (D. F.)	NPO： ≧30pF： Q ≧ 1000 < 30pF ： Q≧400+20C PS: C: Nominal Capacitance (pF) X7R、X5R、Y5V& Z5U：(Max. value)	

T.C.	≧50V	25V	16V	≦10V
X7R/ X5R	2.5%	3.0%	3.5%	5.0%
Z5U	4.0%	---	---	---
Y5V	5.0%	7.5%	9.0%	12.5%

NO.	Item	Performance	Test or Inspection method
(6)	Temperature Characteristic of Capacitance	Temperatures Coefficient (see table A)	The temperature coefficient is determined using the capacitance measured in step 3 as a reference. Test the specimen from step 1 through step 5, the capacitance shall be within the specified tolerance for the capacitance coefficient and capacitance change as left table. (see table B)
(7)	Solderability	New solder to over 95% of termination	Completely soak both terminal electrodes in solder at specified temperature for 3±0.5 sec.: a. For Tin-Lead Sn/Pb) Termination product: 235±5℃ b. For Lead-free (Pure Sn) Termination product: 245±5℃
(8)	Leaching	New solder to over 95% of termination	Completely soak both terminal electrodes in solder at 270±5℃ for 40±1 sec.
(9)	Soldering to Heat	External appearance: No mechanical damage. Cap. change (ΔC/C): see table C D.F.: see table D I.R.: see below	Completely immerse both terminations in solder at 270±5℃ for 10±3 sec. Leave the capacitors in ambient condition for 24± 2 hours before measurement. *Preconditioning：(only for Class 2): Perform a heat treatment at 150 +0-10℃ for one hour and then let sit for 24 ± 2 hours at room temperature. Perform the initial measurement.

Table A — (6) Temperatures Coefficient

T.C.	Operating Temperature	Capacitance Change(ΔC)
NPO	-55~+125℃	0±30(ppm/℃)
X7R	-55~+125℃	± 15%
X5R	-55~+85℃	± 15%
Y5V	-30~+85℃	＋22%~－82%
Z5U	+10~+85℃	+22%~ -56%

Table B — (6) Test steps

Step	Temperature(℃)
1	Base Temp.(25℃)± 2 ℃
2	Min. Operation Temp.± 2 ℃
3	Base Temp.(25℃)± 2 ℃
4	Max. Operation Temp.± 2 ℃
5	Base Temp.(25℃)± 2 ℃

Table C — (9) Cap. change (ΔC/C)

T.C.	Cap. change
NPO	±2.5% or ± 0.25 pF max. (Whichever is larger)
X7R/X5R	±7.5%
Z5U	±20%
Y5V	±20%

Table D — (9) D.F.

NPO: C≧30pF：Q≧1000
C ＜30pF：Q≧400+20*C
PS: C: Nominal Capacitance (pF)

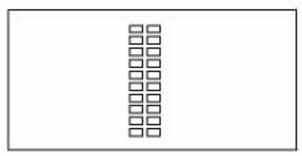
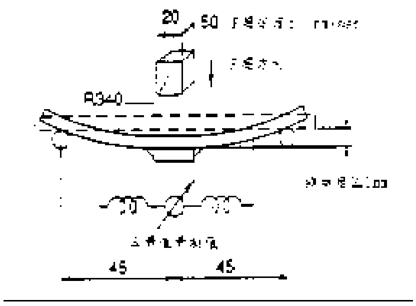
X7R、X5R、Y5V&Z5U：(Max. value)

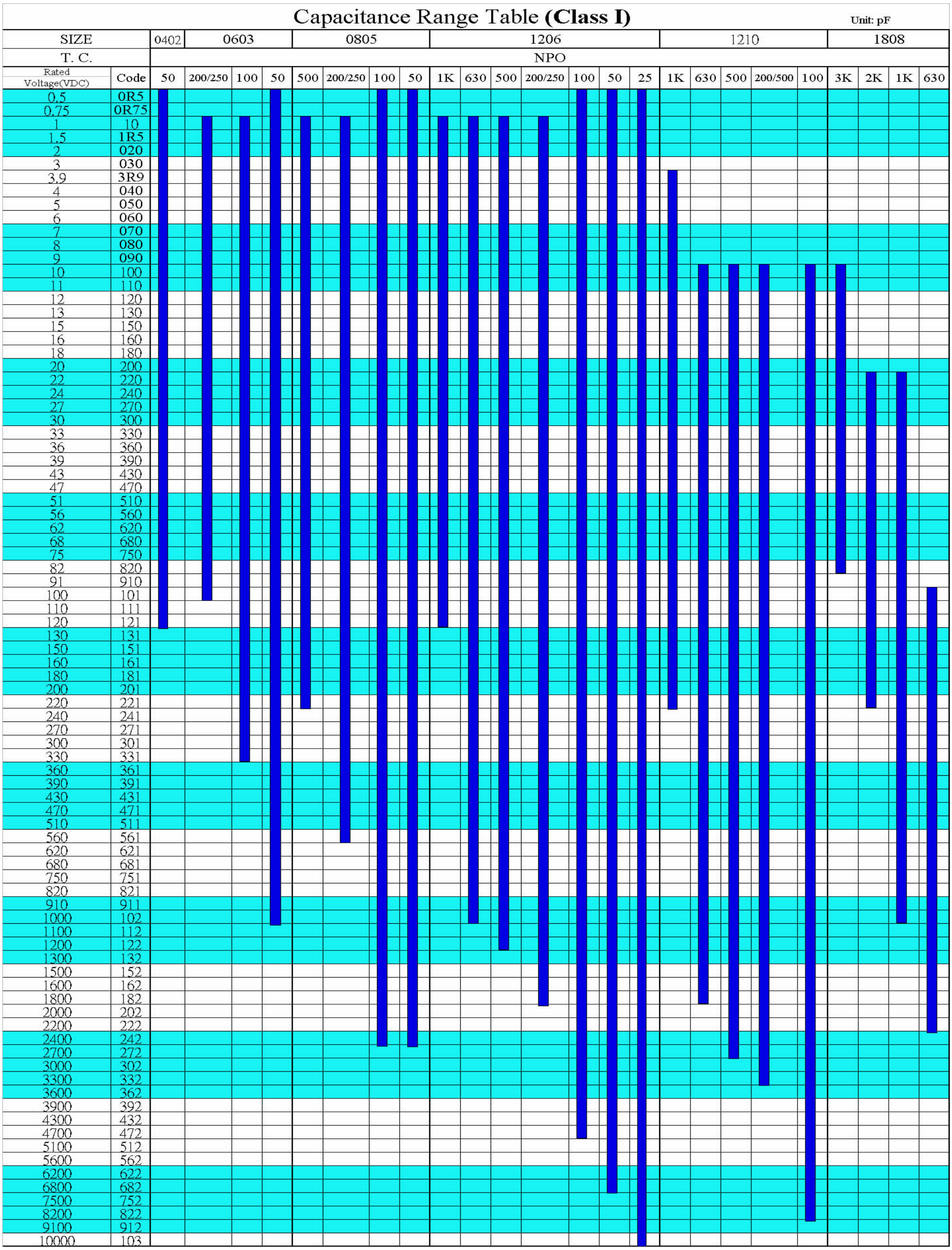
T.C.	≧50V	25V	16V	≦10V
X7R/ X5R	2.5%	3.0%	3.5%	5.0%
Z5U	4.0%	---	---	---
Y5V	5.0%	7.5%	9.0%	12.5%

(9) I.R.:

NPO:
100,000MΩ Min. or
R・C ≧ 1,000 Ω・F
(Whichever is smaller)
X7R、X5R、Y5V、Z5U:
10,000MΩ Min or
R・C ≧ 1,000Ω・F
(Whichever is smaller)

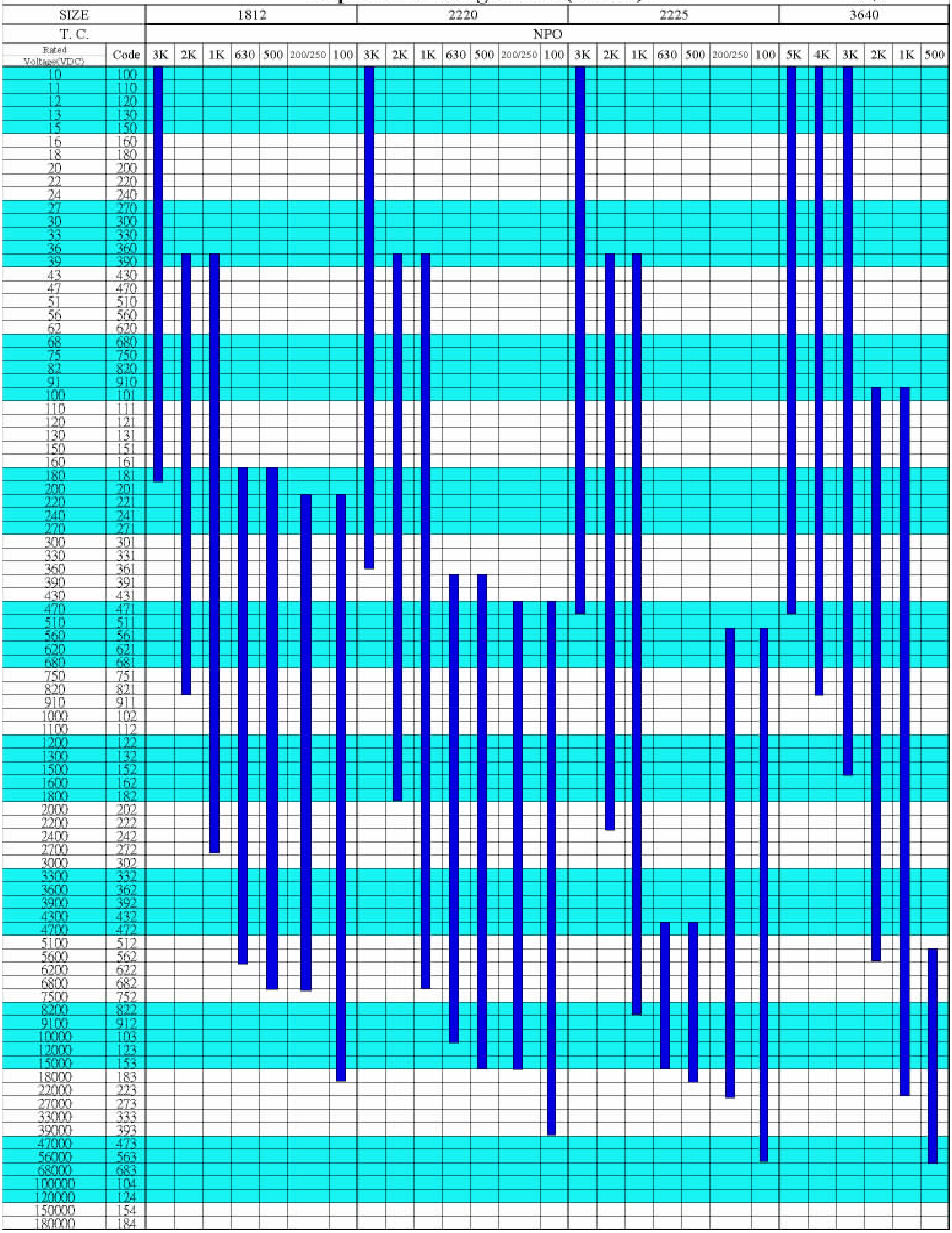
NO.	Item		Performance	Test or Inspection method
(10)	Humidity (Steady state) & Humidity load	External appearance	No mechanical damage.	A. Humidity load: (Not apply for the product with rated voltage ≧ 250V): Apply the rated voltage at temperature 40±2℃ and humidity 90 to 95%RH for 1000＋48/－0 hours. Leave the capacitors in ambient condition for the following time before measurement. Class 1：1~2 hours. Class 2：24± 2 hours. * Charge / discharge current shall. not exceed 50 mA. * Preconditioning：(only for Class 2): Apply the rated DC voltage for 1hour at 40±2℃. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. B. Humidity (Steady state): The test procedure is same as that in Humidity load but only without rated voltage applied.
		Cap. change (ΔC/C)	NPO: ± 5% or ±0.5 pFmax. (Whichever is larger) X7R/ X5R: ± 12.5% Y5V: ±30% Z5U: ±30%	
		D.F.	NPO: C≧30pF: Q ≧350 10pF≦C＜30pF: Q≧100+2.5*C C＜10pF: 200+10*C PS: C: Nominal Capacitance (pF) X7R/ X5R: Less than 2 times of initial value Y5V & Z5U: Less than 1.5 times of initial value	
		I.R.	500MΩ min. or 25Ω*F (Whichever is smaller)	
(11)	Load Life	External appearance	No mechanical damage.	Apply 2x rated voltage at maximum operating temperature ±2℃ for 1000 ＋48/－0 hours. Leave the capacitors in ambient condition for the following time before measurement. Class I: 1~2 hours Class II: 24± 2 hours * Charge / discharge current shall. not exceed 50 mA. * Preconditioning：(only for Class 2): Apply 200% of the rated DC voltage for 1 hour at the maximum operating temperature ± 3℃. Remove and let sit for 24±2 hours at room temperature. Perform initial measurement.
		Cap. change (ΔC/C)	NPO: ±3% or ±0.3pFmax. (Whichever is larger) X7R/ X5R: ± 12.5% Y5V: ±30% Z5U: ±30%	
		D.F.	NPO: C≧30pF: Q≧350 30pF>C≧10pF: Q ≧275+2.5*C C＜10pF：Q≧200+10*C PS: C: Nominal Capacitance (pF) X7R/ X5R: Less than 2 times of initial value Y5V & Z5U: Less than 1.5 times of initial value	
		I.R.	1000MΩ min. or 50Ω*F (Whichever is smaller)	

<table>
<tr><th>NO.</th><th colspan="2">Item</th><th>Performance</th><th>Test or Inspection method</th></tr>
<tr><td rowspan="3">(12)</td><td rowspan="3">Vibration</td><td>External appearance</td><td>Without distinct damage</td><td rowspan="3">(Not apply for 0402 product)
Solder the capacitors to the test jig as shown in figure below with IR-Reflow method. The capacitor shall be subjected to a simple harmonic motion with the entire frequency range, from 10 to 55 Hz and return to 10 Hz ,shall be transverse in 1 min.
Amplitude(total excursion):1.5mm
Amplitude tolerance:± 15%
This motion shall be applied for a period of 2 hours in each of 3 mutually perpendicular directions (a total of 6 hours)
</td></tr>
<tr><td>Cap. change (ΔC/C)</td><td>NPO: ±2.5% or ±0.25pF max.
(Whichever is larger)
X7R/ X5R: ± 7.5%
Y5V、Z5U: ±20%</td></tr>
<tr><td>D.F. or Q</td><td>NPO: C≧30pF：Q≧1000
C＜30pF：Q≧400+20*C
PS: C: Nominal Capacitance (pF)
X7R、X5R、Y5V& Z5U：(Max. value)
<table>
<tr><td>T.C.</td><td>≧50V</td><td>25V</td><td>16V</td><td>≦10V</td></tr>
<tr><td>X7R/ X5R</td><td>2.5%</td><td>3.0%</td><td>3.5%</td><td>5.0%</td></tr>
<tr><td>Z5U</td><td>4.0%</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>Y5V</td><td>5.0%</td><td>7.5%</td><td>9.0%</td><td>12.5%</td></tr>
</table></td></tr>
<tr><td rowspan="3">(13)</td><td rowspan="3">Deflection</td><td>External appearance</td><td>No cracking or marking defects shall occur</td><td rowspan="3"></td></tr>
<tr><td>Bending strength</td><td>Flexure ≧ 1mm</td></tr>
<tr><td>Cap. change (ΔC/C)</td><td>NPO: ±5% or±0.5pFmax.
(Whichever is larger)
X7R/ X5R: ±12.5%
Y5V: ±30%</td></tr>
<tr><td rowspan="4">(14)</td><td rowspan="4">Temperature cycle</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="4">(Not apply for 0402 product)
The capacitor shall be subject 5 cycles according to four heat treatments listed in the following table.
Then Leave the capacitors in ambient condition for the following time before measurement.
Class II: 2 ~ 24 hours
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Duration (min.)</th></tr>
<tr><td>1</td><td>Min. Operation Temp.±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp. (25℃)</td><td>2 ~ 5</td></tr>
<tr><td>3</td><td>Max. Operation Temp.±3</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp. (25℃)</td><td>2 ~ 5</td></tr>
</table>
*Preconditioning：(only for Class 2):
Perform a heat treatment at 150 +0-10℃ for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Cap. change (ΔC/C)</td><td>NPO: ±2.5% or ±0.25pFmax.
(Whichever is larger)
X7R/ X5R: ± 7.5%
Y5V: ± 20%</td></tr>
<tr><td>D.F.</td><td>NPO:
C≧30pF：Q≧1000
C＜30pF：Q≧400+20*C
X7R、X5R Y5V&Z5U: (Max. value)
<table>
<tr><td>T.C.</td><td>≧50V</td><td>25V</td><td>16V</td><td>≦10V</td></tr>
<tr><td>X7R/ X5R</td><td>2.5%</td><td>3.0%</td><td>3.5%</td><td>5.0%</td></tr>
<tr><td>Z5U</td><td>4.0%</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>Y5V</td><td>5.0%</td><td>7.5%</td><td>9.0%</td><td>12.5%</td></tr>
</table></td></tr>
<tr><td>I.R.</td><td>10000MΩ min. or 500Ω*F
(Whichever is smaller)</td></tr>
</table>


Capacitance Range Table (Class I)
Unit: pF
SIZE
0402
0603
0805
1206
1210
1808
T. C.
NPO
Rated Voltage(VDC)
Code
50
200/250
100
50
500
200/250
100
50
1K
630
500
200/250
100
50
25
1K
630
500
200/500
100
3K
2K
1K
630
0.5 0R5
0.75 0R75
1 10
1.5 1R5
2 020
3 030
3.9 3R9
4 040
5 050
6 060
7 070
8 080
9 090
10 100
11 110
12 120
13 130
15 150
16 160
18 180
20 200
22 220
24 240
27 270
30 300
33 330
36 360
39 390
43 430
47 470
51 510
56 560
62 620
68 680
75 750
82 820
91 910
100 101
110 111
120 121
130 131
150 151
160 161
180 181
200 201
220 221
240 241
270 271
300 301
330 331
360 361
390 391
430 431
470 471
510 511
560 561
620 621
680 681
750 751
820 821
910 911
1000 102
1100 112
1200 122
1300 132
1500 152
1600 162
1800 182
2000 202
2200 222
2400 242
2700 272
3000 302
3300 332
3600 362
3900 392
4300 432
4700 472
5100 512
5600 562
6200 622
6800 682
7500 752
8200 822
9100 912
10000 103

Capacitance Range Table (Class I)

Unit: pF



Capacitance Range Table (Class I)

Unit: pF

SIZE		5550						8060					
T. C.		NPO											
Rated Voltage(VDC)	Code	5K	4K	3K	2K	1K	500	5K	4K	3K	2K	1K	500
10	100												
11	110												
12	120												
13	130												
15	150												
16	160												
18	180												
20	200												
22	220												
24	240												
27	270												
30	300												
33	330												
36	360												
39	390												
43	430												
47	470												
51	510												
56	560												
62	620												
68	680												
75	750												
82	820												
91	910												
100	101												
110	111												
120	121												
130	131												
150	151												
160	161												
180	181												
200	201												
220	221												
240	241												
270	271												
300	301												
330	331												
360	361												
390	391	■											
430	431	■											
470	471	■	■	■									
510	511	■	■	■									
560	561	■	■	■									
620	621	■	■	■									
680	681	■	■	■				■	■	■			
750	751	■	■	■				■	■	■			
820	821	■	■	■				■	■	■			
910	911	■	■	■				■	■	■			
1000	102	■	■	■	■	■		■	■	■	■	■	
1100	112		■	■	■	■		■	■	■	■	■	
1200	122		■	■	■	■		■	■	■	■	■	
1300	132		■	■	■	■		■	■	■	■	■	
1500	152		■	■	■	■		■	■	■	■	■	
1600	162			■	■	■		■	■	■	■	■	
1800	182			■	■	■		■	■	■	■	■	
2000	202			■	■	■		■	■	■	■	■	
2200	222			■	■	■		■	■	■	■	■	
2400	242			■	■	■			■	■	■	■	
2700	272			■	■	■			■	■	■	■	
3000	302			■	■	■			■	■	■	■	
3300	332			■	■	■			■	■	■	■	
3600	362				■	■				■	■	■	
3900	392				■	■				■	■	■	
4300	432				■	■				■	■	■	
4700	472				■	■				■	■	■	
5100	512				■	■				■	■	■	
5600	562				■	■				■	■	■	
6200	622				■	■				■	■	■	
6800	682				■	■				■	■	■	
7500	752				■	■					■	■	
8200	822				■	■					■	■	
9100	912				■	■					■	■	
10000	103				■	■	■				■	■	
12000	123					■	■				■	■	
15000	153					■	■				■	■	■
18000	183					■	■				■	■	■
22000	223					■	■					■	■
27000	273					■	■					■	■
33000	333					■	■					■	■
39000	393					■	■					■	■
47000	473						■					■	■
56000	563						■					■	■
68000	683						■					■	■
100000	104						■						■
120000	124												■
150000	154												■
180000	184												■

Capacitance Range Table (Class II)

Unit: pF

SIZE		0402											0603										
T. C.		X7R			X5R					Y5V			X7R					X5R					Z5U
Rated Voltage(VDC)	Code	50	25	16	50	25	16	10	6.3	50	25	16	200/250	100	50	25	16	50	25	16	10	6.3	50
100	101												■	■									
150	151												■	■									
180	181												■	■	■								
220	221	■			■	■	■	■	■				■	■	■								
270	271	■			■	■	■	■	■				■	■	■								
330	331	■			■	■	■	■	■				■	■	■			■	■	■	■	■	
390	391	■			■	■	■	■	■				■	■	■			■	■	■	■	■	
470	471	■	■		■	■	■	■	■				■	■	■			■	■	■	■	■	
560	561	■	■		■	■	■	■	■				■	■	■			■	■	■	■	■	
680	681	■	■		■	■	■	■	■				■	■	■			■	■	■	■	■	
820	821	■	■		■	■	■	■	■				■	■	■			■	■	■	■	■	
1000	102	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
1200	122	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
1500	152	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
1800	182	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
2200	222	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
2700	272	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
3300	332	■	■		■	■	■	■	■	■			■	■	■			■	■	■	■	■	■
3900	392	■	■			■	■	■	■	■			■	■	■			■	■	■	■	■	■
4700	472		■			■	■	■	■	■			■	■	■			■	■	■	■	■	■
5600	562		■			■	■	■	■	■			■	■	■			■	■	■	■	■	■
6800	682		■			■	■	■	■	■				■	■			■	■	■	■	■	■
8200	822			■			■	■	■	■				■	■			■	■	■	■	■	■
10000	103			■			■	■	■	■				■	■	■		■	■	■	■	■	■
12000	123			■			■	■	■	■					■	■		■	■	■	■	■	
15000	153			■			■	■	■	■					■	■		■	■	■	■	■	
18000	183			■			■	■	■						■	■	■		■	■	■	■	
22000	223			■			■	■	■		■				■	■	■		■	■	■	■	
27000	273			■				■	■							■	■		■	■	■	■	
33000	333			■				■	■			■					■		■	■	■	■	
39000	393							■	■			■					■		■	■	■	■	
47000	473							■	■			■					■		■	■	■	■	
56000	563											■					■		■	■	■	■	
68000	683							■	■			■					■		■	■	■	■	
100000	104							■	■			■					■		■	■	■	■	
120000	124																			■	■	■	
150000	154																			■	■	■	
180000	184																			■	■	■	
220000	224								■											■	■	■	
270000	274																				■	■	
330000	334																				■	■	
390000	394																				■	■	
470000	474																				■	■	
560000	564																				■	■	
680000	684																				■	■	
820000	824																				■	■	
1000000	105																				■	■	
1200000	125																					■	
1500000	155																					■	
1800000	185																					■	
2200000	225																					■	
2700000	275																						
3300000	335																						
3900000	395																						
4700000	475																						
5600000	565																						
6800000	685																						
8200000	825																						
10000000	106																						

Capacitance Range Table (Class II)

Unit: pF

SIZE		0603				0805															
T. C.		Y5V				X7R					X5R					Z5U		Y5V			
Rated Voltage(VDC)	Code	50	25	16	10	200/250	100	50	25	16	50	25	16	10	6.3	50	25	50	25	16	10
100	101					●	●														
150	151					●	●	●													
180	181					●	●	●													
220	221					●	●	●													
270	271					●	●	●													
330	331					●	●	●													
390	391					●	●	●													
470	471					●	●	●													
560	561					●	●	●													
680	681					●	●	●			●	●	●	●	●						
820	821					●	●	●			●	●	●	●	●						
1000	102	●				●	●	●			●	●	●	●	●	●	●	●	●		
1200	122	●				●	●	●			●	●	●	●	●	●	●	●	●		
1500	152	●				●	●	●			●	●	●	●	●	●	●	●	●		
1800	182	●				●	●	●			●	●	●	●	●	●	●	●	●		
2200	222	●				●	●	●			●	●	●	●	●	●	●	●	●		
2700	272	●				●	●	●			●	●	●	●	●	●	●	●	●		
3300	332	●	●			●	●	●			●	●	●	●	●	●	●	●	●		
3900	392	●	●			●	●	●			●	●	●	●	●	●	●	●	●		
4700	472	●	●	●		●	●	●			●	●	●	●	●	●	●	●	●		
5600	562	●	●	●		●	●	●			●	●	●	●	●	●	●	●	●		
6800	682	●	●	●		●	●	●			●	●	●	●	●	●	●	●	●		
8200	822	●	●	●		●	●	●			●	●	●	●	●	●	●	●	●		
10000	103	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
12000	123	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
15000	153	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		
18000	183	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●		
22000	223	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●		
27000	273	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●		
33000	333	●	●	●				●	●	●	●	●	●	●	●	●	●	●	●		
39000	393	●	●	●				●	●	●	●	●	●	●	●	●	●	●	●		
47000	473	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●		
56000	563	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●		
68000	683	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●		
100000	104	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●		
120000	124			●	●				●	●		●	●	●	●			●	●		
150000	154			●	●				●	●		●	●	●	●			●	●		
180000	184			●	●					●		●	●	●	●			●	●		
220000	224			●	●					●	●	●	●	●	●			●	●	●	●
270000	274			●	●					●		●	●	●	●				●	●	●
330000	334			●	●					●		●	●	●	●				●	●	●
390000	394				●					●		●	●	●	●					●	●
470000	474				●					●		●	●	●	●					●	●
560000	564				●					●			●	●	●					●	●
680000	684				●					●			●	●	●					●	●
820000	824				●					●			●	●	●					●	●
1000000	105				●					●			●	●	●					●	●
1200000	125														●						●
1500000	155														●						●
1800000	185														●						●
2200000	225													●	●						●
2700000	275																				
3300000	335														●						
3900000	395																				
4700000	475														●						
5600000	565																				
6800000	685																				
8200000	825																				
10000000	106														●						

Capacitance Range Table (Class II)

Unit: pF

SIZE		1206																				1210			
T. C.		X7R								X5R						Z5U	Y5V				X7R				
Rated Voltage(VDC)	Code	1K	630	500	200/250	100	50	25	16	250	50	25	16	10	6.3	50	50	25	16	10	1K	630	500	200/250	100
100	101	■			■	■																			
150	151	■			■	■																			
180	181	■	■	■	■	■															■				
220	221	■	■	■	■	■															■				
270	271	■	■	■	■	■															■				
330	331	■	■	■	■	■	■	■	■												■				
390	391	■	■	■	■	■	■	■	■												■	■	■		
470	471	■	■	■	■	■	■	■	■												■	■	■		
560	561	■	■	■	■	■	■	■	■												■	■	■		
680	681	■	■	■	■	■	■	■	■												■	■	■		
820	821	■	■	■	■	■	■	■	■												■	■	■		
1000	102	■	■	■	■	■	■	■	■							■	■				■	■	■		■
1200	122	■	■	■	■	■	■	■	■							■	■				■	■	■		■
1500	152	■	■	■	■	■	■	■	■							■	■				■	■	■		■
1800	182	■	■	■	■	■	■	■	■							■	■				■	■	■		■
2200	222	■	■	■	■	■	■	■	■							■	■				■	■	■		■
2700	272		■	■	■	■	■	■	■							■	■				■	■	■		■
3300	332		■	■	■	■	■	■	■							■	■				■	■	■		■
3900	392		■	■	■	■	■	■	■							■	■				■	■	■		
4700	472		■	■	■	■	■	■	■							■	■				■	■	■		
5600	562		■	■	■	■	■	■	■							■	■				■	■	■		
6800	682		■	■	■	■	■	■	■							■	■					■	■		
8200	822			■	■	■	■	■	■							■	■					■	■		
10000	103			■	■	■	■	■	■							■	■					■	■	■	
12000	123			■	■	■	■	■	■							■	■					■	■	■	
15000	153			■	■	■	■	■	■							■	■					■	■	■	
18000	183				■	■	■	■	■							■	■					■	■	■	
22000	223				■	■	■	■	■							■	■						■	■	
27000	273				■	■	■	■	■							■	■						■	■	
33000	333				■	■	■	■	■							■	■						■	■	
39000	393				■	■	■	■	■							■	■						■	■	
47000	473				■	■	■	■	■							■	■							■	
56000	563				■	■	■	■	■							■	■							■	
68000	683				■	■	■	■	■		■					■	■	■						■	
100000	104				■	■	■	■	■	■	■	■	■	■	■	■	■	■						■	
120000	124					■	■	■	■		■	■	■	■	■	■	■	■						■	
150000	154					■	■	■	■		■	■	■	■	■	■	■	■						■	
180000	184							■	■		■	■	■	■	■	■	■	■						■	
220000	224							■	■		■	■	■	■	■	■	■	■	■	■					
270000	274							■	■			■	■	■	■				■	■					
330000	334							■	■			■	■	■	■				■	■					
390000	394								■			■	■	■	■				■	■					
470000	474								■			■	■	■	■				■	■					
560000	564											■	■	■	■					■					
680000	684											■	■	■	■					■					
820000	824											■	■	■	■					■					
1000000	105											■	■	■	■										
1200000	125												■	■	■										
1500000	155												■	■	■										
1800000	185												■	■	■										
2200000	225												■	■	■										
2700000	275													■	■										
3300000	335												■	■	■										
3900000	395													■	■										
4700000	475												■	■	■										
5600000	565														■										
6800000	685														■										
8200000	825														■										
10000000	106													■	■										
22000000	226														■										

Capacitance Range Table (Class II)

Unit: pF

SIZE		1210				1808				1812											2220						
T. C.		X5R				X7R				X7R							X5R				X7R						
Rated Voltage(VDC)	Code	25	16	10	6.3	3K	2K	1K	630	3K	2K	1K	630	500	200/250	100	25	16	10	6.3	3K	2K	1K	630	500	200/250	100
100	101					■				■																	
150	151					■				■																	
180	181					■				■											■						
220	221					■	■	■		■											■						
270	271					■	■	■		■											■						
330	331					■	■	■		■											■						
390	391					■	■	■	■	■	■	■	■	■							■	■	■				
470	471					■	■	■	■	■	■	■	■	■							■	■	■				
560	561					■	■	■	■	■	■	■	■	■							■	■	■				
680	681					■	■	■	■	■	■	■	■	■							■	■	■				
820	821						■	■	■	■	■	■	■	■							■	■	■				
1000	102						■	■	■	■	■	■	■	■							■	■	■	■	■		
1200	122						■	■	■	■	■	■	■	■							■	■	■	■	■		
1500	152						■	■	■	■	■	■	■	■							■	■	■	■	■		
1800	182						■	■	■		■	■	■	■							■	■	■	■	■		
2200	222							■	■		■	■	■	■							■	■	■	■	■		
2700	272							■	■		■	■	■	■							■	■	■	■	■		
3300	332							■	■		■	■	■	■								■	■	■	■		
3900	392							■	■		■	■	■	■	■	■						■	■	■	■		
4700	472							■	■		■	■	■	■	■	■						■	■	■	■		
5600	562							■	■			■	■	■	■	■						■	■	■	■		
6800	682							■	■			■	■	■	■	■						■	■	■	■		
8200	822							■	■			■	■	■	■	■						■	■	■	■		
10000	103							■	■			■	■	■	■	■						■	■	■	■	■	■
12000	123								■			■	■	■	■	■						■	■	■	■	■	■
15000	153								■			■	■	■	■	■							■	■	■	■	■
18000	183								■			■	■	■	■	■							■	■	■	■	■
22000	223								■			■	■	■	■	■							■	■	■	■	■
27000	273												■	■	■	■							■	■	■	■	■
33000	333												■	■	■	■							■	■	■	■	■
39000	393												■	■	■	■							■	■	■	■	■
47000	473												■	■	■	■							■	■	■	■	■
56000	563												■	■	■	■							■	■	■	■	■
68000	683												■	■	■	■								■	■	■	■
100000	104												■	■	■	■								■	■	■	■
120000	124													■	■	■								■	■	■	■
150000	154														■	■								■	■	■	■
180000	184														■	■								■	■	■	■
220000	224														■	■								■	■	■	■
270000	274														■	■									■	■	■
330000	334														■	■										■	■
390000	394														■	■										■	■
470000	474														■	■										■	■
560000	564															■										■	■
680000	684	■														■										■	■
820000	824	■																								■	■
1000000	105	■																									■
1200000	125	■																									
1500000	155	■																									
1800000	185	■																									
2200000	225	■																									
2700000	275																										
3300000	335																										
3900000	395																										
4700000	475	■	■																								
5600000	565																										
6800000	685			■													■										
8200000	825			■																							
10000000	106	■	■	■																							
22000000	226				■													■	■								
47000000	476				■															■							
100000000	107																			■							

Capacitance Range Table (Class II)

Unit: pF

T. C.: X7R

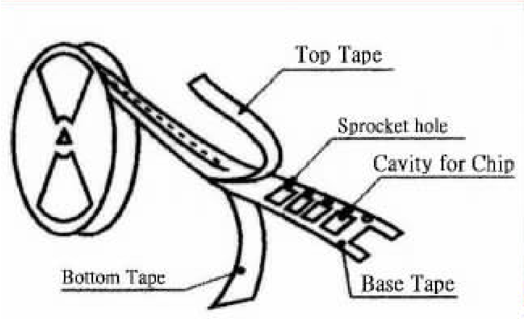
SIZE	Rated Voltage(VDC)	Min (Code)	Max (Code)
2225	3K	180 (181)	3300 (332)
2225	2K	390 (391)	15000 (153)
2225	1K	390 (391)	56000 (563)
2225	630	15000 (153)	220000 (224)
2225	500	15000 (153)	330000 (334)
2225	200/250	18000 (183)	1000000 (105)
2225	100	18000 (183)	1500000 (155)
3640	4K	470 (471)	6800 (682)
3640	3K	470 (471)	10000 (103)
3640	2K	390 (391)	47000 (473)
3640	1K	390 (391)	220000 (224)
3640	500	39000 (393)	1200000 (125)
5550	5K	560 (561)	8200 (822)
5550	4K	1000 (102)	15000 (153)
5550	3K	12000 (123)	27000 (273)
5550	2K	10000 (103)	100000 (104)
5550	1K	10000 (103)	470000 (474)
5550	500	100000 (104)	2200000 (225)
8060	5K	10000 (103)	18000 (183)
8060	4K	10000 (103)	27000 (273)
8060	3K	10000 (103)	56000 (563)
8060	2K	10000 (103)	180000 (184)
8060	1K	1000 (102)	1200000 (125)
8060	500	180000 (184)	3900000 (395)

Capacitance scale (Rated value / Code): 100/101, 150/151, 180/181, 220/221, 270/271, 330/331, 390/391, 470/471, 560/561, 680/681, 820/821, 1000/102, 1200/122, 1500/152, 1800/182, 2200/222, 2700/272, 3300/332, 3900/392, 4700/472, 5600/562, 6800/682, 8200/822, 10000/103, 12000/123, 15000/153, 18000/183, 22000/223, 27000/273, 33000/333, 39000/393, 47000/473, 56000/563, 68000/683, 100000/104, 120000/124, 150000/154, 180000/184, 220000/224, 270000/274, 330000/334, 390000/394, 470000/474, 560000/564, 680000/684, 820000/824, 1000000/105, 1200000/125, 1500000/155, 1800000/185, 2200000/225, 2700000/275, 3300000/335, 3900000/395, 4700000/475, 5600000/565, 6800000/685, 8200000/825, 10000000/106

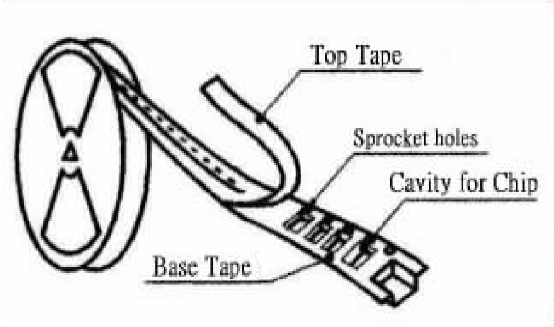
10. Packaging：

(1)Reel specification: Standard reel diameter is 7” and 13”

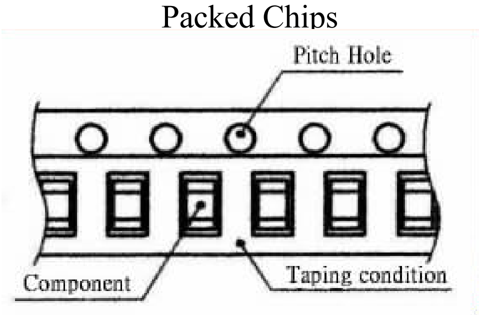
Paper Tape



Plastic Tape



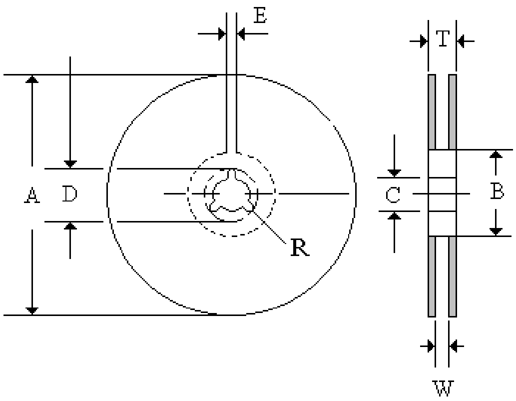
Packed Chips



(2) Quantity for each reel

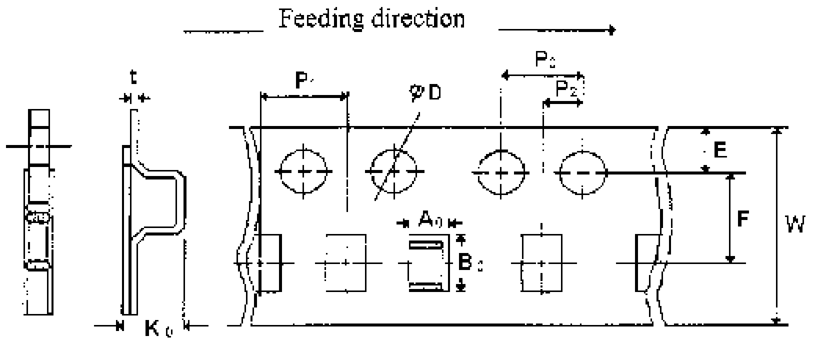
Chip Size		0402	0603	0805	1206	1210	1808	1812	2220	2225	3640	5550	8060
Reel Size	7”	10000	4000	3000	2500	2000	2000	1000	1000	1000	N/A	N/A	N/A
	13”	50000	16000	12000	10000	8000	8000	4000	4000	4000	N/A	N/A	N/A
Tape wide(mm)		8	8	8	8/12	8/12	8/12	8/12	8/12	8/12	N/A	N/A	N/A

(3) Dimension of Reel:



Dimension		A	B	C	D	E	T	W
Reel Size	7”	178±2	50 min.	13±0.5	21±0.8	2.0±0.5	12±2.0	10±1.5
	13”	330 max					18.4max.	12.4 +1.5/-0

(4) Tape Dimension：



Unit: inch (mm)

Symbol	Description	8 mm tape	12 mm tape
W	Wide of Tape	8(0.135)±0.2(0.008)	12(0.472)±0.2(0.008)
F	Distance between drive hole center and cavity center	3.5(0.138)±0.05(0.002)	5.5(0.213)±0.05(0.002)
E	Distance between drive hole center and tape edge	1.75(0.069)±0.1(0.004)	
P_1	Distance between cavity center	4(0.156)±0.1(0.004)	8(0.135)±0.1(0.004)
P_2	Axial distance between drive hole center and cavity center	2(0.079)±0.05(0.002)	
P_0	Axial distance between drive hole	4(0.156)±0.1(0.004)	
D_0	Drive hole diameter	1.5(0.059)+0.1(0.004)-0	
t_1	Base tape thickness	0.3(0.012)±0.1(0.004)	0.4(0.016)±0.1(0.004)
t_2	Total tape thickness	0.1(0.004) max.	

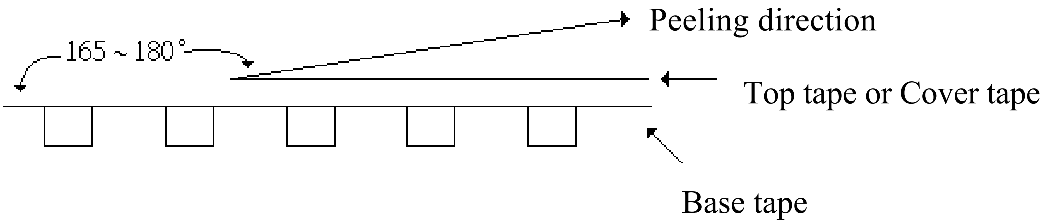
	0402	0603	0805	1206	1210 and above
A_0(Wide of Cavity)	0.65±0.1	1.05±0.1	1.55±0.15	2.0±0.2	Dependent on chip size to minimize rotation
B_0(Length of Cavity)	1.15±0.1	1.85±0.1	2.3±0.15	3.6±0.2	

(5) Peeling off strength of Top tape

The angle between top tape and base tape is 165 ~ 180° , and the peeling speed is control in 300± 10 mm/min, and the peeling force as follows:

a. 8mm tape or base tape : 10 ~ 100 grams (0.1~1.0N)

b. 12mm tape or base tape: 10 ~ 130 grams (0.1~ 1.3N)



PRECAUTION FOR HANDLING

The multi-layer ceramic chip capacitors, may fall in a short circuit mode or in an open-circuit mode when subjected to severe conditions of electrical, environmental and/or mechanical stress beyond the specified "Ratings" and specified "Condition" in the Catalog and the Specifications, resulting in burnout, flaming or glowing in the worst case. So some common sense of application by customer is necessary. Here the following article are some key points that need to take attention in application for customer reference only:

1.Operating Conditions and Circuit Design

1.1 Operating temperature range

The specified "Operating Temperature Range" in the catalog is absolute maximum and minimum temperature rating. So in any case, each the Capacitor shall be operated within the specified "Operating Temperature Range".

1.2 Design of Voltage Applications

The capacitors shall not be operated exceeding the specified "Rated Voltage" in the catalog. If voltage ratings are exceeded the Capacitors could result in failure of damage. In case of application of DC and AC voltage to the capacitors, the designed peak voltage shall be within the specified "Rated Voltage".

1.3 Charging and Discharging Current

The capacitors shall not be operated beyond the specified "Maximum Charging / Discharging Current Rated" in the specification, Application to a low impedance circuit such as a "secondary power circuit" are not recommended for safety.

1.4 Temperature Rise by Dielectric Loss of the capacitor

The "Operating Temperature Range" mentioned above shall include a maximum surface temperature rise of 20℃, which is caused by the Dielectric loss of the Capacitor and applied electrical stress (such as voltage, frequency and wave form etc.)

It is recommended to measure and check "Surface temperature of the Capacitor" in your equipment at your estimated / designed maximum ambient temperature.

1.5 Restriction on Environmental Conditions

The Capacitors shall not be operated and / or stored under following environmental conditions:

(a) To be exposed directly to water or salt water.

(b) To be exposed directly to sunlight.

(c) Under conditions of dew formation.

(d) Under conditions of corrosive atmosphere such as hydrogen sulfas, sulfurous acid, chlorine, or ammonia etc.

(e) Under severe condition of vibrations or shock beyond the specified conditions in the Specifications.

1.6 Secular change in Capacitance

(1) Peculiar characteristics of "Secular Changes in Capacitance" are observed in the Capacitors (Class 2 High Dielectric Constant Temperature Characteristics "X7R" and "Y5V". The "secular change" shall be considered in your circuit design.

(2) The Capacitance change, due to the individual characteristics of ceramic dielectric materials applied, can be recovered to the each initial values at shipping by a heat treatment (140 to 150℃ for 1 hour).

2. Design of Printed Circuit Board

2.1 Selection of Printed Circuit Boards

When the Capacitors are mounted and soldered on an "Aluminum's Substrate has influences on Capacitor's reliability against "Temperatures Cycles" and "Heat shock" because of difference of thermal expansion dose not deterioration the characteristics of the Capacitors.

There are some thermal expansion factor for different kink of PC board material as follows:

PC board material	Thermal expansion factor (mm/℃)
Glass epoxy	1.4×10^{-5}
Paper phenol	2.2×10^{-5}
Composite	2.2×10^{-5}
Alumina	6.5×10^{-6}

2.2 Design of Land Pattern

(1) Recommended Dimensions of Lands. As shown in Table 1 and Fig 1.

Note： * Too large land required excess amount of solder.

** The Dimensions shall be symmetrical.

Fig.1 Recommended Land Dimensions：

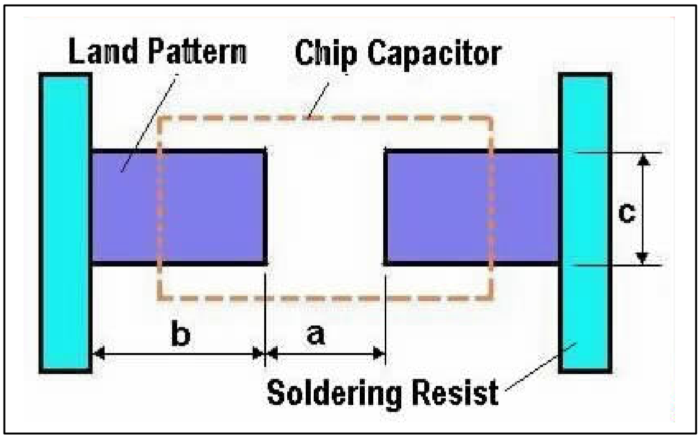


Table 1: Recommended Land Dimensions in mm.

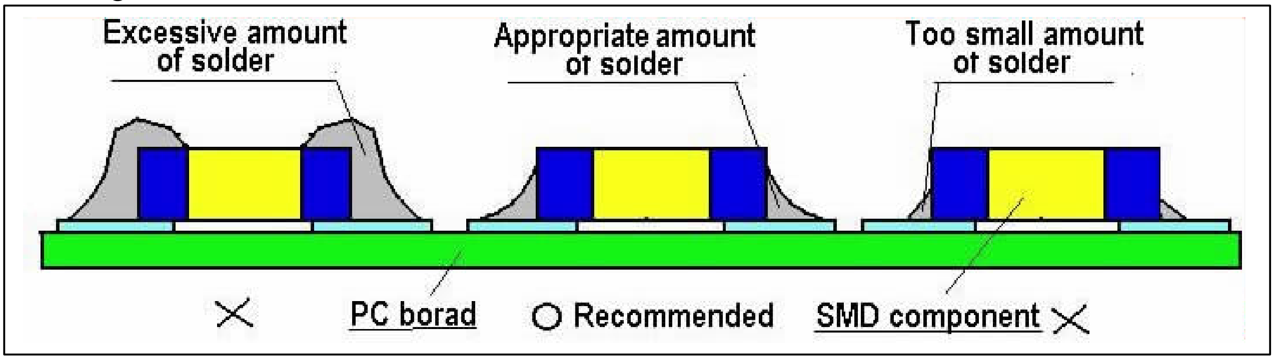
Size	Chip Dimension		Land Dimension		
	L	W	a	b	c
0402	1.0	0.5	0.30~0.50	0.35~0.45	0.40~0.60
0603	1.6	0.8	0.70~1.00	0.80~1.00	0.60~0.80
0805	2.0	1.25	1.00~1.30	1.00~1.20	0.80~1.10
1206	3.2	1.6	2.10~2.50	1.10~1.30	1.10~1.30
1210	3.2	2.5	2.10~2.50	1.10~1.30	1.90~2.30
1808	4.5	2.0	2.50~3.20	1.80~2.30	1.50~1.80
1812	4.5	3.2	2.50~3.20	1.80~2.30	2.60~3.00
2220	5.7	5.0	4.20~4.70	2.00~2.50	4.20~4.70

(2) Recommend amount of solder:

Recommended amount of solder: As shown in Fig 2.

Excess amount of solder gives large mechanical stresses to the capacitors / Components.

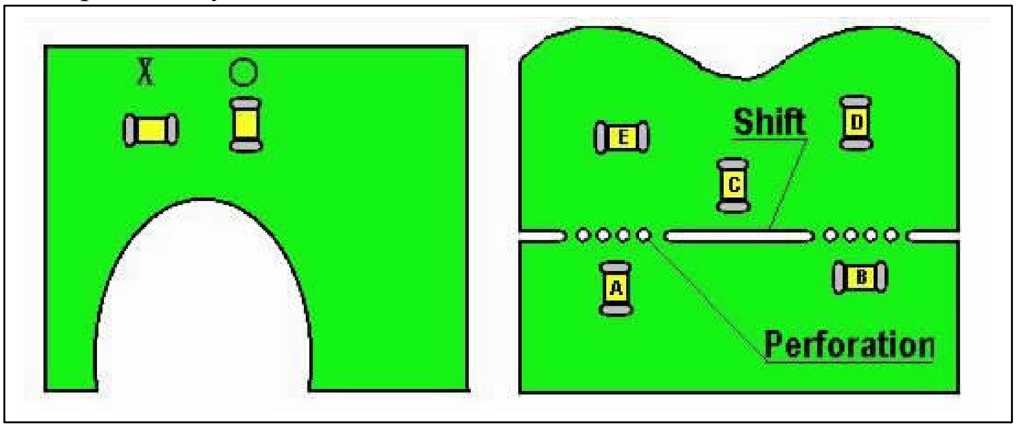
Fig 2: Recommended amount of solder



2.3 Component Layout

When placing / mounting the capacitors / components near an area which is apt to bend or a grid groove on the PC board. It is advisable to have both electrodes subjected to uniform stresses, or to position the component electrodes at right angles to the grid groove or bending line.

Fig 3 : Component Layout



Uneven mounting density

O : Proper ×: Improper

Probability at which the chip capacitor is broken by the stress on PC board break

A＞B＝C＞D＞E

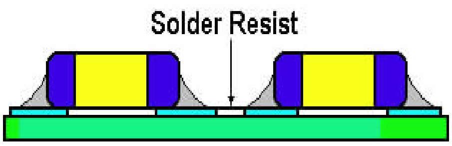
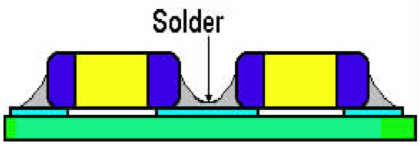
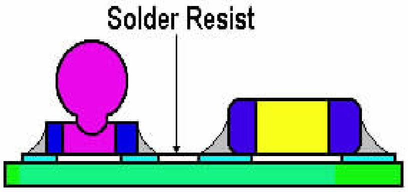
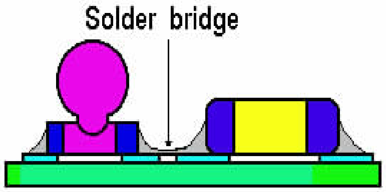
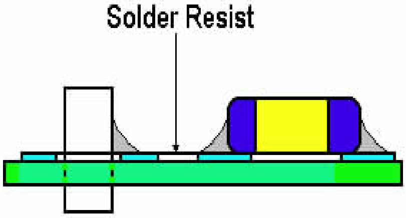
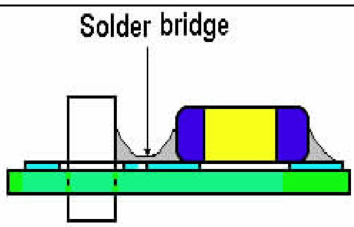
2.4 Mounting Density and Spaces

Placements in too narrow spaces between components may cause " Solder Bridges" during soldering. The minimum space between components shall be 0.5mm in view of the positioning tolerances of the mounting machines and the dimensional tolerances of the components and PC boards.

2.5 Applications of Solder Resist:

Application of Solder Resist are effective to prevent solder bridges and to control amounts of solder on PC boards (As shown in Table 2).

Table 2: Application Examples of Solder Resist

	Recommended Application Examples	Examples of Solder Bridges
Narrow Spacing between Chip Components		
Radial Components are directly connected to Chip Components		
Common lands are close to Chip Components		

3. Precautions for Assembly

3.1 Adhesives for Mounting

(1) Selection of adhesives

a. The viscosity of a adhesive for mountings shall be such that the adhesive dose not flow off on the land during it's curing.

b. If the adhesive is too low in its viscosity, mounted components may be out of alignment after or during soldering.

c. The adhesives shall not be corrosive of chemically active to the mounted components and the PC boards.

d. The amount of adhesive shall be such that the adhesive dose not flow off or be out of alignment.

e. Adhesives for mountings can be cured by ultraviolet or infrared radiation. In order to prevent the terminal electrodes of the Capacitors The curing shall be done at conditions of 180℃ max, for 2 minutes max.

3.2 Chip Mounting consideration

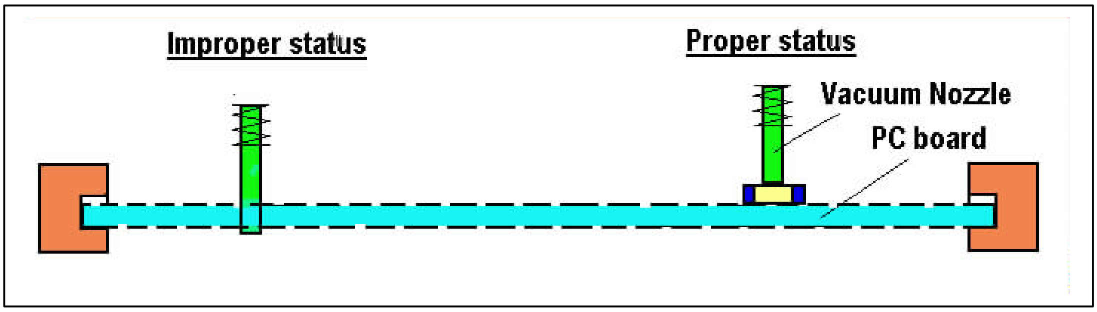
In mounting the Capacitors / components on a printed circuit board, any bending and expanding force against them shall be kept minimum to prevent them from being damaged or cracked.

Following precautions and recommendation shall be observed carefully in the process:

(1) Maximum stroke of the vacuum nozzle shall be adjusted so that the pushing force to the printed circuit board shall be limited to a static of 1 to 3 N (100 to 300 gf) (See Fig.4).

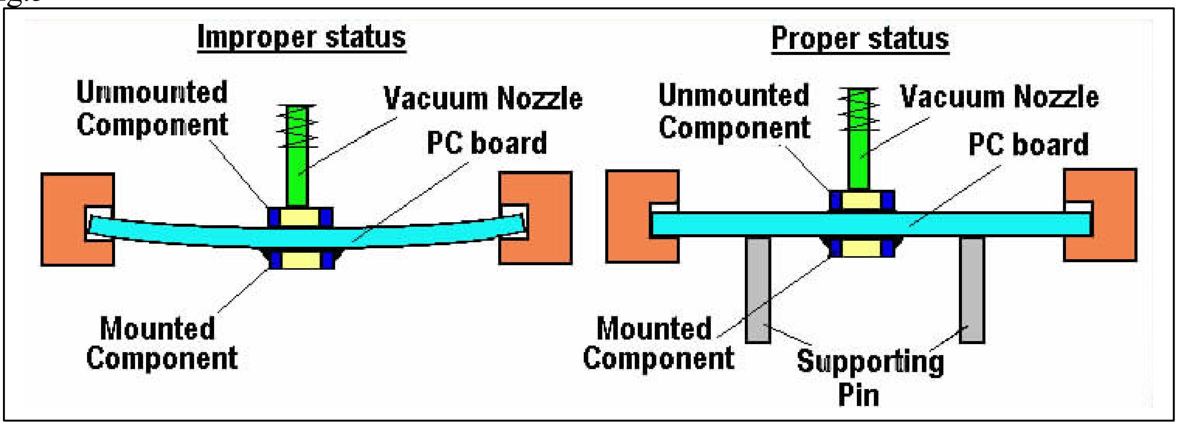
(2) Maximum stroke of the nozzle shall be adjusted so that the maximum bending of printed circuit board dose not exceeded 0.5mm (See Fig.4)

Fig.4



(3) The printed circuit board shall be supported by means of adequate supporting pins as shown in Fig.5-(b)

Fig.5



3.3 Soldering Flux and Solder

(1) Solder Flux:

a. The content of halogen in the soldering shall be 0.2 wt% or less.

b. Rosin-based and non-activated soldering flux is recommended.

(2) Water soluble type Soldering Flux:

In case of water soluble type soldering flux being applied, the flux residue on the surface of PC boards may have influences on the reliability of the components and cause deterioration and failures of them.

(3) Solder:

An eutectic solder (Sn63：Pb37) is recommended.

3.4 Soldering

Since a multilayer ceramic chip capacitor comes into direct contact with melted solder during soldering. It is exposed to potentially damaging mechanical stress caused by the sudden temperature change. The capacitor may also be subject to silver migration, and to contamination by the flux. Because of these factors, soldering technique is critical. Adhere to the following guidelines.

3.4.1 Hand soldering:

In hand soldering of the Capacitors, large temperature gradient between preheated the capacitors and the tip of soldering iron may cause electrical failures and mechanical damages such as cracking of breaking of the devices. The soldering shall be carefully controlled and carried out so that the temperature gradient is kept minimum with following recommended conditions for hand soldering.

Recommended Soldering Conditions:

(1) Solder:

φ 1mm Thread eutectic solder (Sn63:Pb37) with soldering flux *in the core.

*Rosin-based, and mom-activated flux is recommended.

(2) Preheating:

The capacitors shall be preheated so that "Temperature Gradient" between the devices and the tip of soldering iron is 150℃ or below.

(3) Soldering iron:

Rated Power of 20W Max with 3mm soldering tip in diameter.

Temperature of soldering iron tip: 300℃ max.

(The required amount of solder shall be melted in advance on the soldering tip.)

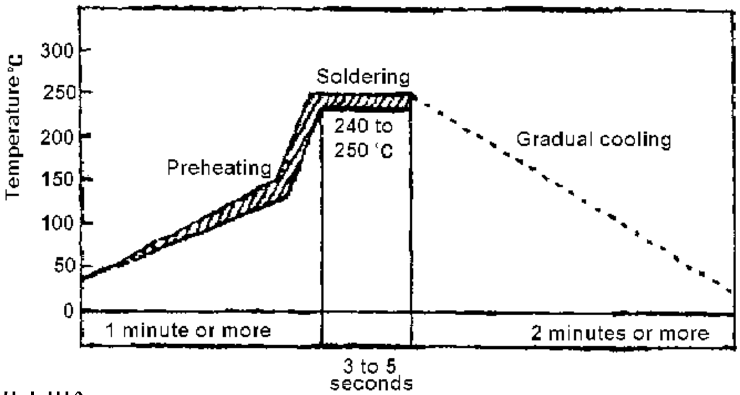
(4) Cooling:

After soldering, the Capacitors shall cooled gradually at room ambient temperature.

3.4.2.Flow Soldering

In flow soldering process, abnormal and thermal and mechanical stresses, caused by "Temperature Gradient" between the mounted Capacitors, resulting in failures and damages of the capacitors. So it is essential that the soldering process shall controlled to the following recommended conditions and precautions.(See Fig.6)

Fig.6. Recommended Soldering Temperature Time Profile (Flow soldering)



(1) Application of Flux:

The soldering flux(3.3) shall applied to the mounted Capacitors thinly and uniformly by forming method.

(2) Preheating:

The mounted Capacitors / Components shall be preheated sufficiently so that the " Temperature Gradient" between the Capacitors / Components and the melted solder shall be 150℃ or below.

(3) Immersion to Soldering Bath:

The Capacitors shall be immersed into a soldering bath of 240 to 250℃ for 3 to 5 seconds.

(4) Cooling:

The Capacitors shall be cooled gradually to room ambient temperature with the cooling temperature rates of 8℃/s max. from 250℃ to 170℃ and 4℃/s max. from 170℃ to 130℃.

(5) Flux Cleaning:

When the Capacitors are immersed into cleaning solvent, it shall be confirmed that the surface temperature of devices do not exceed 100℃(See 3.5).

3.4.3 Reflow soldering.

In reflow soldering process, the mounted Capacitors / Components are generally heated and Soldering by a thermal conduction system such as an "Infrared radiation and hot blast soldering system" or a "Vapor Phase Soldering System(VPS)", Large temperature gradients such as a rapid heating and cooling in the process may cause electrical and mechanical damages if the device. It is essential that the soldering process shall be controlled by following recommended conditions and precaution.(See Fig.7)

3.4.3.1 For Tin-Lead (Sn/Pb) Termination component:

(1) Preheating 1.

The mounted Capacitors / Components shall be preheated sufficiently, for 60 to 90 seconds so that the surface temperature of them to be 140 to 150℃.

(2) Preheating 2.

After "Preheating 1", the mounted Capacitors / Components shall be the elevated temperature of 150 to 200℃ for 2 to 6 Seconds.

(3) Soldering:

The mounted Capacitors / Components shall be heated under the specified heating conditions (200 to 240 to 200℃ for total 20 to 40 seconds, See Fig.7) and shall be soldered at the maximum temperature of 240℃ for 10 seconds of less.

(4) Cooling:

After the soldering, the mounted Capacitors / Components shall be gradually cooled to room ambient temperature for preventing mechanical damages such as cracking of the devices.

(5) Flux Cleaning:

When the mounted Capacitors / Components are immersed into cleaning solvent, it shall be confirmed the surfaces temperatures of them do not exceeding 100℃.

Note: If the mounted Capacitors / Components are partially heated in the soldering process, the devices may be separated form the printed circuit board by the surface tension of partially melted solder, and stand up like a "Tomb Stone".

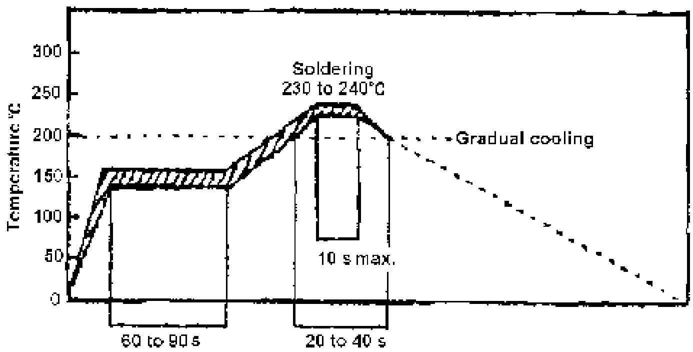


Fig.7. Recommended Soldering Temperature Time Profile for Tin-Lead component (Reflow Soldering)

3.4.3.2 For Lead-free (Pure Tin plating termination) Termination component:

Essentially, the soldering temperature for Lead-free component is a little higher than that for Tin-Lead component, but need to take consideration of the thermal effect for all other components mounting on board at the same time. The below picture is a recommended soldering profile for Lead-free component :

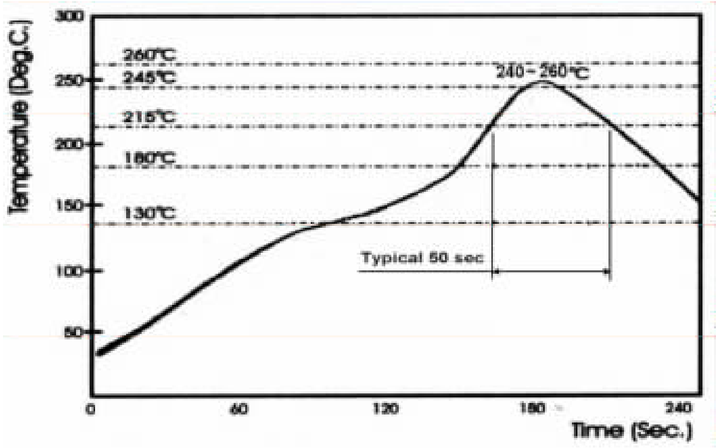


Fig.8 Recommended Soldering Temperature Time Profile for Lead-free component (Reflow Soldering)

3.5 Post soldering Cleaning

(1) Residues of corrosive soldering fluxes on the PC board after cleaning may greatly have influences on the electrical characteristics and the reliability, (such as humidity resistance) of the Capacitors, which have been mounted on the board. It shall be confirmed that the characteristic and reliability at the devices are no effected by applied cleaning conditions.

(2) Solubility of alternative cleaning solvent such as alcohol etc., is inferior to that of Freon cleaning solvent in the flux cleaning.

So in case of alternative cleaning solvents, fresh cleaning solvent shall be used, and sufficient rinsing and drying shall carried out.

(3) When an ultrasonic cleaning is applied to the mounted Capacitors on PC board, following conditions energy and the recommended for preventing failures or damages of the devices due to the large vibration energy and the resonant caused by the ultrasonic waves.

Frequency :29KHz max.

Radiated Power :20 W/liter max.

Period :5 minutes max.

3.6 Process Inspection

When the mounted printed circuit are inspected with measuring terminal pins, abnormal and excess mechanical stresses shall not be applied to the PC board mounted components, to prevent failure or damages of the devices.

(1) The mounted PC board shall be supported a same adequate supporting pins prevent their banding.

(2) It shall be confirmed that the measuring pin have the right tip in shape, equal in height and are set in the tight positions.

(3) The amount of adhesive shall be such that the adhesive dose flow off or be out of alignment.

3.7 Protective Coating

When the surface of a printed board on which the Capacitors has been mounted is coated with Resin to protect against moisture and dust, it shall be confirmed that the protective coat dose not have influences on reliability of the capacitors in the actual equipment.

(1) Coating materials, such as being corrosive and chemically active, shall not be applied to the capacitors and other components.

(2) Coating materials with a large expansively shall not be applied to the Capacitors for preventing failures or damages (such as cracking) of the devices in the curing process.

3.8 Dividing / Breaking of PC boards

(1) Abnormal and excessive mechanical stresses, such as bending or expanding force on the components on the printed circuit board, shall be kept minimum in the dividing / breaking.

(2) Dividing / Breaking of the PC board shall be done carefully at moderate speed using a Jig boards from mechanical damages.

3.9 Long Term Storage

The Capacitors shall not be stored under severe conditions of high temperatures and high humidity. Store them under 40℃ max. and 75%RH max. Use them within 6 months and check the solderability before use.